CLAIMS

Sub B3

1. An encoder having means for calculating the DCT of a sequence of length N/2, N being a positive, even integer,

characterised by

- means for calculating a DCT of length N directly from two sequences of length N/2 representing the first and second half of an original sequence of length N.

2. An encoder having means for calculating the DCT of a sequence of length N/2xN/2, N being a positive, even integer,

characterised by

- means for calculating an NxN DCT directly from four DCTs of length (N/2xN/2) representing the DCTs of four adjacent blocks constituting the NxN block.

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3. An encoder according to claim 1 ~~any of claims 1 or 2~~, **characterised in** that the means for calculating DCTs of length N/2 are arranged to calculate the even coefficients of a DCT of length N as:

$$X_{2k} = \sqrt{\frac{2}{N}}\varepsilon_{2k}\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)2\kappa\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k \left\{ \sum_{n=0}^{\frac{N}{2}-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=N/2}^{N-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} \right\}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k \left\{ \sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=0}^{\frac{N}{2}-1} x_{N-1-n} \cos\left[\frac{[2(N-1-n)+1]\kappa\pi}{2(N/2)}\right] \right\}$$

$$= \sqrt{\frac{1}{2}} \left\{ \sqrt{\frac{2}{N/2}}\varepsilon_k \sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sqrt{\frac{2}{N/2}}\varepsilon_k \sum_{n=0}^{\frac{N}{2}-1} z_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} \right\}$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + (-1)^k Z_k\right]$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + Z'_k\right] \qquad k = 0,1,\ldots,(N/2)-1.$$

and the odd coefficients $R_k = X_{2k+1}$ as

$$R_k = R_k' - R_{k-1}$$

where

$$R'_k = \sqrt{\frac{2}{N}}\left\{\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k+1)\pi}{2N} + \sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k-1)\pi}{2N}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\,\varepsilon_k \sum_{n=0}^{\frac{N}{2}-1}(y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}\cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\,\varepsilon_k \sum_{n=0}^{\frac{N}{2}-1} r_n \cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

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or

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\{\text{ length-N/2 DCT-II of } r_n\}$$

where

$$r_n = (y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Y_l \cos\frac{(2n+1)l\pi}{2(N/2)} - \sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Z'_l \cos\frac{(2n+1)l\pi}{2(N/2)}\right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l (Y_l - Z'_l)\cos\frac{(2n+1)l\pi}{2(N/2)} - \right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$= g_n 2\cos\frac{(2n+1)\pi}{2N}$$

where
g_n is a length-N/2 IDCT of (Y_l-Z'_l), and where
$R'_k = X_{2k+1} + X_{2k-1}$.

or as

$$X_{2k+1} = \sqrt{\frac{2}{N}}\varepsilon_{2k+1}\sum_{i=0} x_i \cos\frac{(2i+1)(2\kappa+1)\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} x_{i+N/2}\cos\frac{(2i+N+1)(2k+1)\pi}{2N}\right\}$$

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$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} z_i \cos\left[\frac{(2i+1)(2k+1)\pi}{2N} + (k\pi + \frac{\pi}{2})\right]\right\}.$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + (-1)^{k+1}\sum_{i=0}^{\frac{N}{2}-1} z_i \sin\frac{(2i+1)(2k+1)\pi}{2N}\right\}$$

$$= \sqrt{\frac{2}{N}}(X1_k - (-1)^k X2_k), \quad k = 0,1,\ldots,(N/2)-1.$$

SUB A1> 4. A encoder according to any of claims 1 - 3, **characterised in** that N is equal to 2^m, m being a positive integer > 0

5. A decoder having means for calculating the DCT of a sequence of length N/2, N being a positive, even integer,
characterised by
- means for calculating a DCT of length N directly from two sequences of length N/2 representing the first and second half of an original sequence of length N.

6. A decoder having means for calculating the DCT of a sequence of length N/2xN/2, N being a positive, even integer,
, **characterised by**
- means for calculating an NxN DCT directly from four DCTs of length (N/2xN/2) representing the DCTs of four adjacent blocks constituting the NxN block.

A 7. A decoder according to claim 1 ~~any of claims 1 or 2~~, **characterised in** that the means for calculating DCTs of length N/2 are arranged to calculate the even coefficients of a DCT of length N as:

$$X_{2k} = \sqrt{\frac{2}{N}}\varepsilon_{2k}\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)2\kappa\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=N/2}^{N-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=0}^{\frac{N}{2}-1} x_{N-1-n} \cos\left[\frac{[2(N-1-n)+1]\kappa\pi}{2(N/2)}\right]\right\}$$

$$= \sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} z_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\}$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + (-1)^k Z_k\right]$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + Z'_k\right] \qquad k = 0,1,\ldots,(N/2)-1.$$

and the odd coefficients $R_k = X_{2k+1}$ as

$$R_k = R_k^{'} - R_{k-1}$$

where

$$R_k^{'} = \sqrt{\frac{2}{N}}\left\{\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k+1)\pi}{2N} + \sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k-1)\pi}{2N}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1}(y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}\cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} r_n \cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

or

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\{\text{ length-N/2 DCT-II of } r_n\}$$

where

$$r_n = (y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{ \sqrt{\frac{2}{N/2}} \sum_{l=0}^{\frac{N}{2}-1} \varepsilon_l Y_l \cos\frac{(2n+1)l\pi}{2(N/2)} - \sqrt{\frac{2}{N/2}} \sum_{l=0}^{\frac{N}{2}-1} \varepsilon_l Z'_l \cos\frac{(2n+1)l\pi}{2(N/2)} \right\} 2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{ \sqrt{\frac{2}{N/2}} \sum_{l=0}^{\frac{N}{2}-1} \varepsilon_l (Y_l - Z'_l) \cos\frac{(2n+1)l\pi}{2(N/2)} - \right\} 2\cos\frac{(2n+1)\pi}{2N}$$

$$= g_n 2\cos\frac{(2n+1)\pi}{2N}$$

where

g_n is a length-N/2 IDCT of ($Y_l - Z'_l$), and where

$R'_k = X_{2k+1} + X_{2k-1}$.

or as

$$X_{2k+1} = \sqrt{\frac{2}{N}} \varepsilon_{2k+1} \sum_{i=0}^{N-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N}$$

$$= \sqrt{\frac{2}{N}} \left\{ \sum_{i=0}^{\frac{N}{2}-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} x_{i+N/2} \cos\frac{(2i+N+1)(2k+1)\pi}{2N} \right\}$$

$$= \sqrt{\frac{2}{N}} \left\{ \sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} z_i \cos\left[\frac{(2i+1)(2k+1)\pi}{2N} + (k\pi + \frac{\pi}{2})\right] \right\}.$$

$$= \sqrt{\frac{2}{N}} \left\{ \sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + (-1)^{k+1} \sum_{i=0}^{\frac{N}{2}-1} z_i \sin\frac{(2i+1)(2k+1)\pi}{2N} \right\}$$

$$= \sqrt{\frac{2}{N}} (X1_k - (-1)^k X2_k), \quad k = 0,1,\ldots,(N/2)-1.$$

SUB A27

8. A decoder according to any of claims 5 - 7, **characterised in** that N is equal to 2^m, m being a positive integer > 0

9. A transcoder comprising an encoder or decoder according to any of claims 1 - 8.

10. A system for transmitting DCT transformed image or video data comprising an encoder or decoder according to any of claims 1 - 8.

Sub B6 11. A method of encoding an image in the compressed (DCT) domain, using DCTs of lengths N/2 and wherein the compressed frames are undersampled by a certain factor in each dimension, **characterised in** that an NxN DCT is directly calculated from 4 adjacent N/2xN/2 blocks of DCT coefficients of the incoming compressed frames, N being a positive, even integer.

12. A method of encoding an image represented as a DCT transformed sequence of length N, N being a positive, even integer, **characterised in** that the DCT is calculated directly from two sequences of length N/2 representing the first and second half of the original sequence of length N.

A 13. A method according to claim 11 ~~any of claims 11 or 12,~~ **characterised in** that the even coefficients of a DCT of length N are calculated as:

$$
\begin{aligned}
X_{2k} &= \sqrt{\frac{2}{N}}\varepsilon_{2k}\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)2\kappa\pi}{2N} \\
&= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=N/2}^{N-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\} \\
&= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=0}^{\frac{N}{2}-1} x_{N-1-n} \cos\left[\frac{[2(N-1-n)+1]\kappa\pi}{2(N/2)}\right]\right\} \\
&= \sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} z_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\} \\
&= \sqrt{\frac{1}{2}}\left[Y_k + (-1)^k Z_k\right] \\
&= \sqrt{\frac{1}{2}}\left[Y_k + Z'_k\right] \qquad k = 0,1,\ldots,(N/2)-1.
\end{aligned}
$$

and the odd coefficients $R_k = X_{2k+1}$ as

$$R_k = R_k' - R_{k-1}$$

where

$$R_k' = \sqrt{\frac{2}{N}}\left\{\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k+1)\pi}{2N} + \sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k-1)\pi}{2N}\right\}$$

$$=\frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1}(y_n-z'_n)2\cos\frac{(2n+1)\pi}{2N}\cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

$$=\frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1}r_n\cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

or

$$=\frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\{\text{ length-N/2 DCT-II of } r_n\}$$

B6 cont'd

where

$$r_n=(y_n-z'_n)2\cos\frac{(2n+1)\pi}{2N}$$

$$=\left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Y_l\cos\frac{(2n+1)l\pi}{2(N/2)}-\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Z'_l\cos\frac{(2n+1)l\pi}{2(N/2)}\right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$=\left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l(Y_l-Z'_l)\cos\frac{(2n+1)l\pi}{2(N/2)}-\right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$=g_n 2\cos\frac{(2n+1)\pi}{2N}$$

where
g_n is a length-N/2 IDCT of (Y_l - Z'_l), and where
$R'_k = X_{2k+1} + X_{2k-1}$.

or as

$$X_{2k+1} = \sqrt{\frac{2}{N}}\varepsilon_{2k+1}\sum_{i=0}^{N-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} x_{i+N/2} \cos\frac{(2i+N+1)(2k+1)\pi}{2N}\right\}$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} z_i \cos\left[\frac{(2i+1)(2k+1)\pi}{2N} + (k\pi + \frac{\pi}{2})\right]\right\}.$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + (-1)^{k+1}\sum_{i=0}^{\frac{N}{2}-1} z_i \sin\frac{(2i+1)(2k+1)\pi}{2N}\right\}$$

$$= \sqrt{\frac{2}{N}}(X1_k - (-1)^k X2_k), \quad k = 0,1,\ldots,(N/2)-1.$$

B6 concl.

SUB A3 14. A method according to any of claims 11 - 13, **characterised in** that N is equal to 2^m, m being a positive integer > 0

Sub B8 15. A method of decoding an image represented as a DCT transformed sequence of length N, N being a positive, even integer, **characterised in** that the DCT is calculated directly from two sequences of length N/2 representing the first and second half of the original sequence of length N.

16. A method of decoding an image in the compressed (DCT) domain, using DCTs of lengths N/2 and wherein the compressed frames are undersampled by a certain factor in each dimension, **characterised in** that an NxN DCT is directly calculated from 4 adjacent N/2xN/2 blocks of DCT coefficients of the incoming compressed frames, N being a positive, even integer.

A 17. A method according to claim 15 ~~any of claims 15 or 16~~, **characterised in** that the even coefficients of a DCT of length N are calculated as:

$$X_{2k} = \sqrt{\frac{2}{N}}\varepsilon_{2k}\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)2k\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=N/2}^{N-1} x_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\}$$

$$= \sqrt{\frac{2}{N}}\varepsilon_k\left\{\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sum_{n=0}^{\frac{N}{2}-1} x_{N-1-n} \cos\left[\frac{[2(N-1-n)+1]\kappa\pi}{2(N/2)}\right]\right\}$$

$$= \sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} y_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)} + \sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} z_n \cos\frac{(2n+1)\kappa\pi}{2(N/2)}\right\}$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + (-1)^k Z_k\right]$$

$$= \sqrt{\frac{1}{2}}\left[Y_k + Z'_k\right] \qquad k = 0,1,\ldots,(N/2)-1.$$

B8 cont'd

and the odd coefficients $R_k = X_{2k+1}$ as

$$R_k = R_k' - R_{k-1}$$

where

$$R_k' = \sqrt{\frac{2}{N}}\left\{\sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k+1)\pi}{2N} + \sum_{n=0}^{N-1} x_n \cos\frac{(2n+1)(2k-1)\pi}{2N}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} (y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}\cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\left\{\sqrt{\frac{2}{N/2}}\varepsilon_k\sum_{n=0}^{\frac{N}{2}-1} r_n \cos\frac{(2n+1)k\pi}{2(N/2)}\right\}$$

or

$$= \frac{1}{\varepsilon_k}\sqrt{\frac{1}{2}}\{\text{ length-N/2 DCT-II of } r_n\}$$

where

$$r_n = (y_n - z'_n)2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Y_l \cos\frac{(2n+1)l\pi}{2(N/2)} - \sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l Z'_l \cos\frac{(2n+1)l\pi}{2(N/2)}\right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$= \left\{\sqrt{\frac{2}{N/2}}\sum_{l=0}^{\frac{N}{2}-1}\varepsilon_l (Y_l - Z'_l)\cos\frac{(2n+1)l\pi}{2(N/2)} -\right\}2\cos\frac{(2n+1)\pi}{2N}$$

$$= g_n 2\cos\frac{(2n+1)\pi}{2N}$$

B8 concl.

where
g_n is a length-N/2 IDCT of $(Y_l - Z'_l)$, and where
$R'_k = X_{2k+1} + X_{2k-1}$.

or as

$$X_{2k+1} = \sqrt{\frac{2}{N}}\varepsilon_{2k+1}\sum_{i=0}^{N-1} x_i \cos\frac{(2i+1)(2\kappa+1)\pi}{2N}$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} x_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} x_{i+N/2}\cos\frac{(2i+N+1)(2k+1)\pi}{2N}\right\}$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + \sum_{i=0}^{\frac{N}{2}-1} z_i \cos\left[\frac{(2i+1)(2k+1)\pi}{2N} + (k\pi + \frac{\pi}{2})\right]\right\}.$$

$$= \sqrt{\frac{2}{N}}\left\{\sum_{i=0}^{\frac{N}{2}-1} y_i \cos\frac{(2i+1)(2k+1)\pi}{2N} + (-1)^{k+1}\sum_{i=0}^{\frac{N}{2}-1} z_i \sin\frac{(2i+1)(2k+1)\pi}{2N}\right\}$$

$$= \sqrt{\frac{2}{N}}(X1_k - (-1)^k X2_k), \quad k = 0,1,\ldots,(N/2)-1.$$

SUB A4 18. A method according to any of claims 15 - 17, **characterised in** that N is equal to 2^m, m being a positive integer > 0.

Sub B10 19. A method of transcoding an image in the compressed (DCT) domain, using DCTs of lengths N/2 and wherein the compressed frames are undersampled by a certain factor in each dimension, **characterised in** that an NxN DCT is directly calculated from 4 adjacent N/2xN/2 blocks of DCT coefficients of the incoming compressed frames, N being a positive, even integer.

20. An encoder comprising means for performing DCT tranformation of a sequence of length N/2, N being a positive, even integer,

characterised by

- means for calculating the DCT of length N directly from two sequences of length N/2 representing the first and second half of an original sequence of length N/2 only using DCTs of length N/2. .

B10 concl.

21. A method of encoding an image represented as a sequence of length N, N being a positive, even integer,

characterised in

that the DCT of length N is calculated directly from two sequences of length N/2 representing the first and second half of an original sequence of length N only using DCTs of length N/2.

add B11